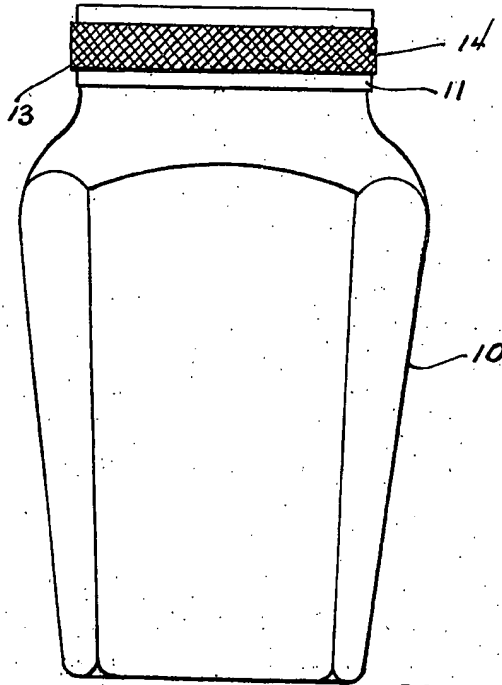


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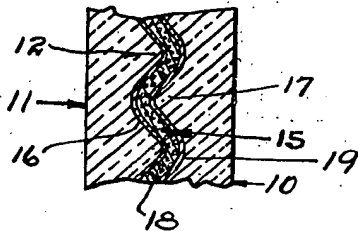
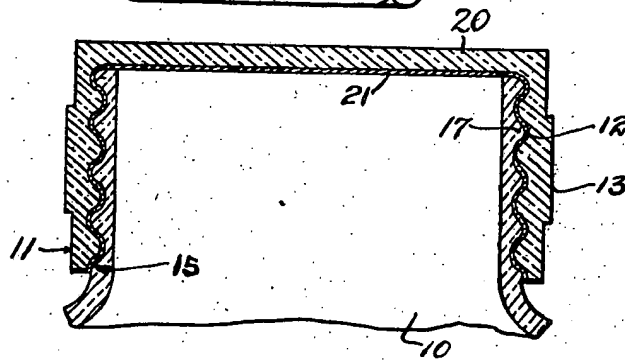
J. P. STAPLES  
SEALING CONTAINER  
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2,390,561

*Fig. 1.*



*Fig. 2.*



*Fig. 3.*

J. P. STAPLES  
Inventor

Olen E. Bee  
Attorney

## UNITED STATES PATENT OFFICE

2,390,561

## SEALING CONTAINER

Julian P. Staples, Mount Lebanon, Pa., assignor to  
Pittsburgh Corning Corporation, Allegheny  
County, Pa., a corporation of Pennsylvania

Application June 27, 1942, Serial No. 448,746

2 Claims. (Cl. 215-43)

The present invention relates to caulking or gasketing systems for use in the joints between composite bodies comprising a plurality of rigid parts secured together in abutting or overlapping relationship and it has particular relation to a system suitable for use between the screw threaded rim portions of glass containers and the screw threaded closures therefor, to provide a seal between the overlapping surfaces.

One object of the invention is to provide a gasketing composition that can be adhered to one member in a joint and which will yield or distort sufficiently to compensate for irregularities in the surface and to allow for inequalities due to thermal expansion, or contraction of the parts.

A second object is to provide a composition that will adhere to one element of a joint without adherence to the other and which will still deform to the contours and relative movements of the non-adhering surface and thus provide a satisfactory seal.

A third object is to provide a new gasketing material satisfactory for use in place of rubber, cork and the like.

A fourth object is to provide a gasketing material which can be spread as a relatively thin and economical adherent layer upon the threads of a screw cap container, and which will provide a perfect seal between the threads without actually bonding to the surfaces of the container.

These and other objects of the invention will be apparent from consideration of the following specification and the appended claims.

It has heretofore been customary to seal joints in composite bodies composed of a plurality of rigid parts, by means of gaskets of highly springy material, such as cork or rubber. The common glass container for example has customarily been closed by screw cap or crimped cap stamped from sheet metal and having a ring or an insert of rubber or cork providing a yieldable bearing member between the glass and the metal entirely around the opening of the container. Metals for caps, at least under present day conditions, are expensive if not impossible to obtain and they are also subject to corrosion and are not very durable. Moreover, they may contaminate or cause deterioration of the contents of the container. Likewise rubber and cork sealing rings and inserts for the caps are now very difficult to obtain and usually are but short lived.

It has heretofore been proposed to substitute glass caps for metal caps for containers, thus saving valuable metal and obviating corrosion. However, this within itself does not eliminate the

necessity of inserts and rings for sealing purposes. Furthermore, the contacting of glass threads of a glass cap with similar threads of a glass container would be highly objectionable because friction would not be sufficiently great to obviate slippage. Chipping or breaking of the threads, due to jars or to unequal thermal adjustments, would be likely. These problems have not heretofore been solved and the elimination of metal caps and rubber or cork sealing members for glass containers has not heretofore been obtained.

The use of plastics as sealing elements possibly might suggest itself for the purpose. Possibly it might be suggested to coat the threads of the container or the closure element with a solution of plastic, which would adhere to the parts, when the cap is screwed down, thus providing a complete and perfect seal. However, in actual practice such system is not satisfactory, because the parts are permanently cemented or bonded together and it would be impossible to remove the closure without breaking the glass. Moreover, the solvents are likely to contaminate the products, such as food products. If it were proposed to apply the plastics to the threads as solutions and then to evaporate the solvents, difficulty would be experienced, because practically all of the plastics which would be possible for use as sealing media are relatively hard, rigid and incompressible so that they would not yield without cutting by the threads to follow small irregularities in the surfaces to be sealed, which irregularities are of course impossible to obviate in a cheap commercial product, such as a glass container.

The present invention involves the use as a sealing medium between overlapping solid surfaces, such as the caps for mouths of containers, of porous plastic composition in which the pores provide for internal displacement of the plastic when pressure is applied, and also imparts a certain degree of compressibility and spring or resilience to the plastic, thus insuring that it can be deformed sufficiently to allow the cap to pass over the mouth of the container, even though the diameter of the inner surface of the plastic is somewhat less than the outer diameter of the mouth.

A convenient method of forming such porous plastic composition upon a surface is illustrated in Jordan patent application Serial No. 375,551, filed January 23, 1941 now Patent No. 2,333,723. The same procedure can be applied to the deposition of gasket coatings in jar caps or the like. According to this method a highly concentrated

viscous solution of a plastic is prepared by dissolving such plastics as vinyl acetate, vinyl acetal, or a copolymer of vinyl acetate and vinyl chloride or even vinyl chloride in a volatile solvent, such as ethyl alcohol or acetone. A solution of a concentration of 25 to 30 percent solids is satisfactory for the purpose. In order to obtain high concentration of solids and low viscosity for spraying the solution should be heated. For example, a 25 or 30 percent solution of polyvinyl butyral resin operates satisfactorily in a spray gun at a temperature of about 165° F. Other plastics may require slightly higher or lower temperatures. Plasticizers, such as diethyl or dibutyl phthalate, diethylene glycol, dihexoate and the like, may be included. For example, polyvinyl butyrate may include 22 to 35 percent of diethylene dihexoate. The lower percentages will give a harder, more heat-resistant coating.

The hot solutions are sprayed onto one or more of the surfaces between which a seal is desired, and due to the temperature of the solution much of the alcohol flashes into vapor almost immediately upon leaving the spray gun. It is probable that some of these vapors are entrapped in the film of plastic as it is formed. Likewise some of the air employed as a spreading medium may be entrapped. In any event, the plastic as it is laid down is filled with minute bubbles and the plastic medium immediately becomes so viscous that the bubbles can not escape. The degree of porosity and fineness of the pores may be increased by forced drying of the film. The shorter the period of drying for a given resin solution, the more pronounced these properties will be. Consequently it may be desirable to bake the partially dried films at a moderate temperature, or to dry under vacuum.

A layer of plastic sufficient to fill the space between the cap and mouth of the container and to accommodate for any irregularities between the surfaces is deposited in this manner. Usually a thickness will be within a range of about 1 to 20 thousandths of an inch, though greater or lesser thickness may be deposited to meet special requirements.

The plastic, as laid down, might be somewhat adherent in nature, even when dried and might possibly act as a bond to cement both of the overlapping surfaces together in permanent relationship. This of course would be highly objectionable in the case of glass containers having glass or metal caps. In accordance with the present invention it is proposed to obviate any such effect by dusting the surface of the plastic while it still contains a small amount of solvent. Suitable dusting agents comprise any of the common pigmentary materials. Among them may be included finely-divided calcium carbonate, such as may be obtained by chemical precipitation, bentonite, flake aluminum, graphite, carbon black and many others. The powder or pigment will adhere as a thin layer to the plastic tacky surface and will render it permanently non-adhesive with respect to the glass or other surface with which it may later be brought into contact. It is contemplated that some plastics, such as vinyl chloride will be non-tacky with respect to glass when hardened and will not require pigment coating.

If it is desired to increase the moisture resistance of the bond between the surface and a porous vinyl polymer layer (e. g. vinyl chloride or vinyl chloride-acetate or vinyl acetate layer) which is spread upon the surface, the surface

may first be coated with a suitable medium, such as hydrolyzed ethyl silicate, or a mixture of 10 parts hydrolyzed ethyl silicate, 10 parts vinyl acetate, 80 parts ethyl alcohol, which bonds readily to glass and also will bond to many of the plastics including vinyl acetal, vinyl acetate, vinyl chloride and copolymer resins of vinyl acetate and vinyl chloride. Alcohol or acetone solutions of these may be sprayed onto the ethyl silicate coated glass while hot and will flash into a cellular layer of sufficient rigidity to retain the gaseous bubbles permanently entrapped. Of course many of the plastics including vinyl butyrate, vinyl acetate, methyl methacrylate and others are inherently adhesive to glass and similar materials and do not require the use of an additional adhesive.

Vinyl plastics are especially satisfactory for use in the present invention because they are inert and non-poisonous. They are, also, highly thermoplastic, so that they set to solid non-tacky state immediately upon cooling and reduction of solvent content. However, vinyl plastics are not always required. Other plastics including "Thiokol" and such cellulosic plastics as nitrocellulose and cellulose acetate may be sprayed upon the caps to provide cellular gasket layers. The bond of these may be increased by means of a sizing coat of gelatin or the like spread directly upon the glass.

Drying oils, such as tung oil, linseed oil and the like may also be employed to size the surface for the reception of porous layers of alkyd resins, phenol-formaldehyde resins, urea-formaldehyde resins and the like. These of course should be employed in an intermediate or soluble stage of polymerization. The resins may be further cured by baking after application.

In case the containers are to be subjected to considerable heat as for instance in cooking or sterilizing operations and the plastic is of low melting point, it may be desirable to add thereto considerable amounts of pigments, such as titanium dioxide, calcium carbonate, carbon black, etc., which will greatly retard any tendency of the resin to flow. Particular reference has been made to the application and formation of cellular plastic sealing coatings by spraying the plastic. However, other methods are also contemplated. For example, the closures might be partially or completely dipped in a hot, concentrated solution of plastic under pressure. By suddenly releasing the pressure, the coating would be bloated.

Also the plastic solutions might be mixed with gassing agents, such as ammonium carbonate and applied by brushing or dipping. If the film were then baked before it became completely solidified carbon dioxide bubbles would be released in the film to give a cellular product.

Embodiments of the invention are illustrated in the drawing in which

Fig. 1 is an elevational view of a container having a glass top constructed in accordance with the provisions of the present invention;

Fig. 2 is a fragmentary sectional view of a container with a glass top suitable for use in the practice of the invention;

Fig. 3 is a fragmentary sectional view showing on a larger scale a portion of the top which has been treated in accordance with the provisions of the invention and a mating section of the container.

In the drawing, a glass container or jar 10 of any convenient form is provided with a cap 11

preferably formed of glass and having internal threads 12 as shown in Fig. 2. The top may have a band 13 scored or checked as indicated at 14, in order to permit it to be gripped firmly for purposes of unscrewing or tightening it. This cap is provided with an inner lining 15 which, optionally, may include a size or bonding coat 16 directly adherent to the surface of the glass and consisting of ethyl silicate, gelatin, drying oil or the like dependent upon the composition of sealing layer subsequently to be applied.

The threads 12 engage corresponding threads 17 about the tubular mouth of the jar, but preferably the inner diameter of the cap is sufficiently greater than the outer diameter of the top of the jar, to tolerate any reasonable degree of distortion of interfitting parts, and also to leave space for a layer 18 of cellular plastic. The layer—while uncompressed—should be slightly greater in thickness than the space between the surfaces. It should have sufficient porosity or cellularity that it can pack down or compress when the cap is applied to allow the threads to mesh without the plastic actually being cut, and without imposing excessive pressure between the parts. Probably a percentage of voids of from about 30 to 75 percent will be satisfactory. The cells are usually quite small in diameter, even microscopic, so that several occur in any given thickness of the coating.

The layer 18 preferably is applied by spraying a concentrated and hot solution of one of the plastics herein enumerated, but other methods may be employed. The plastic by nature is practically incompressible, but by reason of the cells in it the film is readily compressible and has sufficient spring or elasticity to follow any reasonable irregularity in the parts and to compensate for expansion or contraction of the parts with thermal changes.

Layer 19 is a pigmentary material applied by dusting or rubbing to render the layer 18 non-adherent with respect to the top of the jar. If the plastic in layer 18 is inherently non-adhesive it will not be required.

With a glass container and a glass cap it is of course necessary that a layer of plastic be disposed between the threads. However, it is also possible to coat the lower face of the top 20 of the cap to provide in effect an insert 21, which, when the cap is screwed down, is engaged by the top edge of the jar as shown in Fig. 2, thus providing an additional seal. The porous layer may be applied either to the cap or to the jar, or to both, though the latter is seldom necessary.

It will be apparent that the sealing layer herein

disclosed is inexpensive to apply both from the standpoint of labor and the quantities of material required. No highly strategic materials are required, and the coatings are not subject to rapid deterioration. The overlapping parts are adequately cushioned from each other and the possibility of the closures and the mouths of the containers being frozen together is obviated.

Particular reference has been made to glass containers and glass caps, since such system has heretofore been impracticable. However, metal may replace glass in either or both of them.

The forms of the invention herein described are to be regarded merely as exemplary. It will be apparent to those skilled in the art that numerous modifications may be made therein without departure from the spirit of the invention or the scope of the appended claims.

What I claim is:

1. The combination comprising a glass container formed with a tubular mouth element having a set of screw threads, a closure element for the mouth element, the closure element having a set of screw threads mating with the threads of the mouth element, one element constituting an internal part, the other an external part, the internal part being sufficiently smaller than the external part to leave a space between contiguous surfaces of the two, a sealing layer of cellular plastic containing about 30 to 75 percent of voids bonded to one of the sets of screw threads and being non-adherent with respect to the other set, said sealing layer when uncompressed being thicker than the space between said parts but being of a sufficiently cellular structure to permit it to yield to conform to the dimensions of the space to provide a seal when the closure element is screwed in place.

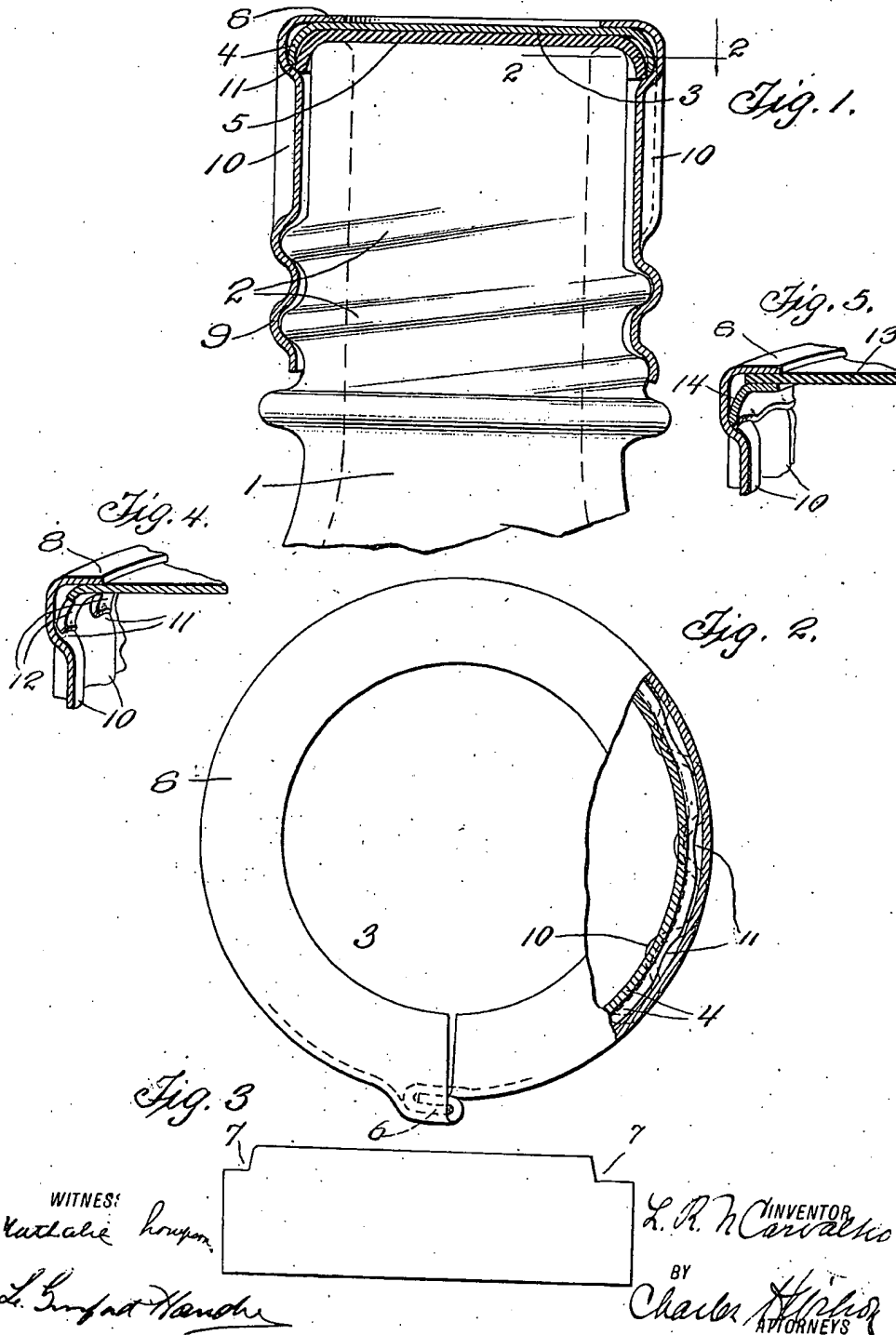
2. The combination comprising a glass container formed with a tubular mouth having a set of external screw threads, a glass cap for the mouth, the cap having a set of internal screw threads mating with the threads of the mouth, the cap being of greater internal diameter than the mouth to leave a slight space between the inner surface of the cap and the outer surface of the mouth, a sealing layer of plastic bonded to one of the sets of threads and being non-adherent with respect to the other set, said sealing layer when uncompressed being slightly thicker than the space between the surfaces but containing about 30 to 75 percent of voids to permit it to yield to conform to the dimensions of the space to provide a seal between the threads.

JULIAN P. STAPLES.

L. R. N. CARVALHO.  
METALLIC CAP FOR RECEPTACLES.  
APPLICATION FILED JAN. 18, 1913.

1,137,725.

Patented Apr. 27, 1915.



WITNES:  
Karl L. Hump

L. L. Hump

L. R. N. CARVALHO INVENTOR

BY Charles H. Hump ATTORNEYS

# UNITED STATES PATENT OFFICE.

LESLIE R. N. CARVALHO, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO  
MARTIN KING, OF BROOKLYN, NEW YORK.

## METALLIC CAP FOR RECEPTACLES.

1,137,725.

Specification of Letters Patent.

Patented Apr. 27, 1915.

Application filed January 18, 1913. Serial No. 742,849.

*To all whom it may concern:*

Be it known that I, LESLIE R. N. CARVALHO, residing at Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Metallic Caps for Receptacles, of which the following is a specification.

This invention relates to a receptacle closure and particularly to that type comprising a portion for covering the open end of the receptacle, and a pendent flange portion, threaded or otherwise provided with means for detachably engaging coöperative portions formed upon the exterior surface of the receptacle.

The particular object of the present invention is to provide a closure of this class made up of two separately formed parts, and to provide a simple and efficient means for positively locking said two parts rigidly together. And a further and more detailed object is to form the flange portion of the structure independently from that portion which is intended to cover the open end of the receptacle, and to provide said separately formed flange portion with struck-in parts for retaining the cover portion in rigid relation thereto, and to adapt said struck-in parts also to retain a sanitary lining in fixed relation against the under surface of the cover portion.

While this invention may be practised in the manufacture of closures for receptacles having any size openings, it is, however, of particular value in the production of closures for receptacles having relatively small openings, such for instance as ordinary catchup bottles and the like. Closures for such bottles comprise a small cover part and a relatively deep, or wide, flange part. These small closures heretofore have always been formed by drawing the metal to form the wide flange and this operation has precluded the possibility of ornamenting the cover part with a printed design, for the reason that such ornamentation must necessarily be impressed before the drawing operation and would of course be defaced in the drawing operation. By forming the cover part independently of the flange any desired ornamentation may be impressed without danger of defacement.

Other objects and aims of the invention, more or less specific than those referred to above, will be in part obvious and in part pointed out in the course of the following description of the elements, combinations, arrangements of parts and applications of principles, constituting the invention; and the scope of protection contemplated will be indicated in the appended claims.

In the accompanying drawings which are to be taken as a part of this specification, and in which I have shown a merely preferred form of embodiment of the invention: Figure 1 is a transverse, vertical, sectional view, partly in elevation, of a closure constructed in accordance with the provisions of this invention, the same being shown as applied to a bottle; Fig. 2 is an enlarged top plan view of the closure, parts being broken away and illustrated in section for better disclosing details of construction; Fig. 3 is a plan view on a reduced scale illustrating the blank used in the formation of the flange portion of the device; and Figs. 4 and 5 illustrate modifications.

Referring to the drawings for a full description of the device, the numeral 1 indicates the bottle which may be provided with a threaded exterior surface at 2. The closure illustrated comprises a disk portions 3 arranged for closing the open end of the bottle and having its marginal portion 4 turned downwardly to a slight extent about the annular outer edge of the bottle. A lining 5 may be interposed between the disk and the upper surface of the bottle for sanitary and sealing purposes, if desired. It will be observed from the drawing that the lining 5 is held in position within the tubular member through its engagement with the corrugated portions 10 and that said lining covers and conceals the edge of the disk 3.

The flange portion of the device is formed independently of the disk 3 and comprises preferably a band of thin metal, see Fig. 3, bent into tubular formation and seamed together along its abutting edges as by a seam 6. Seam 6 is what may be termed an interfolded seam in that the edges of the strip are covered and concealed by the seam itself. The manner of forming the seam,

as will be noted, positively locks the ends of the strip against relative endwise movement. The blank from which the band or flange is formed is preferably provided with cut-away portions as 7, at its upper opposite corners as shown, so as to provide a portion at the upper end of the tubular member, formed by the band, which is not seamed, and the upper annular edge of the tube is bent to form an inwardly projecting annular flange 8. The lower portion of the tube is pressed to provide a plurality of corrugations which extend lengthwise of the strip of material constituting the tubular member, said corrugations when the ends of the band of metal are together forming continuous threads 9 for mating the threads 2 on the bottle, and intermediate the threaded portion and the upper annular edge, the tube is provided with corrugations 10 formed by striking in the material in a well-known manner. The corrugations or threads 9, extend across and indent the material of the band of metal at its joined ends whereby relative lateral movement of the ends of the band is prevented. The corrugations 9 and the seamed portions of the ends of the band therefore, of themselves, hold the joined ends firmly together and prevent any relative movement. The disk portion of the closure is arranged within the tube intermediate the upper ends of the corrugations 10 and the under surface of the annular flange 8, the down-turned part 4 of the disk having its annular edge portion resting upon the upper inclined ends 11 of said corrugations whereby the disk and tube are rigidly and permanently locked together, the tube comprising, in effect, a deep flange formed integrally upon the disk. The structure thus formed may obviously be used without the lining 5, as, for instance, when the closure is employed in a temporary manner for closing a bottle, such as a catchup or other similar bottle which is in constant use. When, however, the lining is employed its outer annular edge may rest upon the upper ends 11 of the corrugations 10 in much the same manner as does the outer annular edge of the disk 3, and the lining is consequently also held in a relatively locked position.

It may be advantageous for a better understanding of the precise manner in which the disk and flange portion of the closure are rigidly locked together, to give here a brief description of the important steps employed in the manufacture, as follows: After the tube has been made from a suitable blank as above described, or otherwise, if preferred, and the upper annular edge turned inwardly to form the portion 8, and before the corrugations and threads have been formed upon the tube, the disk 3 is inserted within the tube so that its upper, or

outer, face engages the inner face of the flange 8, which in effect, comprises an annular shoulder against which the disk may be forced. The diameter of the disk is just sufficient to permit its passage between the then smooth walls of the tube. At this time the annular edge of the disk is also smooth. With the disk thus positioned, the closure is subjected to an operation whereby the corrugations 10 are impressed, and the material of the tube as at 11 forced against the bottom edge of the disk, causing said edge to be wedged upwardly as is clearly seen by reference to the drawing. This wedge action results in more or less mutilation or bending of the edge of the disk, which mutilation and bending will serve to more intimately connect the parts in rigid relation. The portions 11 of the corrugations form a relatively inclined or cam-like ledge or shoulder within the tube, and the downturned part or flange 4 of the cover 3 forms a spring member engaging this cam-like ledge or shoulder and urging the cover 3 constantly upward.

As clearly shown in Fig. 1 of the drawings, the flange 4 does not extend straight downwardly from the plane of the disk portion 3, but is inclined or curved outwardly and downwardly on a wide radius, and that the lower edge of the flange engages the upper inclined or beveled surface of the corrugations or reinforcing ribs 11, and that the bent, or resilient tendency, of the lower edge of the flange to spring outwardly is exerted upon said inclined surface in a wedge-like manner. The downward and outward inclination of the flange 4 is seen to be such that an approximate pivot about which the flange swings is positioned somewhat nearer to the center of the cover part than the lower edge of the flange, so that, in moving outwardly, said lower edge will also move upwardly. The angle of pressure against the inclined surface is very acute. In this manner the wedge-like action of the lower edge of the flange in engaging the inclined surface will produce a force which materially increases the normal resiliency of the metal in forcing the disk toward the under surface of the shoulder 8. It is apparent, that in such a structure, the disk is not subjected to any severe manipulation during the assembling of the parts, and I may therefore paint or print upon the upper surface of the disk any suitable advertising matter or design without fear of its defacement. Such advertising or other matter will obviously lie in a plane below the outer surface of the flange portion 8 of the tube, and will consequently be protected to a greater or less extent by said flange portion against defacement by foreign objects.

Since the irregularities of surface of the flange or tubular portion of the closure are

formed by simple pressure and hence the tubular portion is not subjected to the severe hardship of being drawn, this part, as well as the disk part, may be lacquered over or painted or printed with an advertising design or the like, before being pressed, if desired, without fear of defacement.

The disk portion 3 may, if desired, be formed of card-board instead of metal, and in this instance, the card-board itself may serve as a washer or lining for engaging the upper edge of the bottle, and sealing the bottle without the necessity for a separate lining.

The structure illustrated in Fig. 4 is the same as that above described, except that the turned down portion of the disk 3 comprises only a series of spaced ears or extensions 12 instead of the continuous formation 4 shown in the previous figures, or by making the part 4 narrower and making the ears 12 as enlargements thereon. These ears will engage the surfaces 11 of the corrugations 10 and retain the parts in rigid relation in the same manner as already described, and the part will require less material in its formation, and will result in a lighter weight and less expensive structure. The ears or extensions will give more readily to the formation of the corrugations of the tube, and thus render the operation of forming the corrugations that much easier. They will also form independent spring members yieldingly pressing upon the inclined surface 11 of the corrugations to wedge the cover upwardly.

The structure shown in Fig. 5 illustrates the use of a separately formed locking member for the disk part of the closure. In this instance the disk 13 is formed without the turned down marginal part 4 and a separate ring shaped locking member 14 of substantially L cross section is employed in its stead, one leg of the L engaging, and being subjected to the wedge action of the upper ends of the corrugations 10 in the same manner as is the part 4, and the other leg of the L engaging beneath the disk 13 and forcing the disk against the flange 8. In this structure the disk 13 may be made of paper or cardboard, and the closure be correspondingly cheaper, without detracting from the rigidity of the connection of the disk within the tubular part.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the language used in the following claims is intended to cover all of the generic

and specific features of the invention herein described and all statements of the scope of the invention, which as a matter of language, might be said to fall therebetween.

Having thus described my invention what I claim as new and desire to secure by Letters Patent, is:

1. A receptacle closure comprising a tubular part having an inturned annular shoulder at one end, and a separately formed cover part disposed within the tubular part engaging the under surface of said shoulder to close that end of the tubular part, said cover part having a downturned marginal flange extending away from said shoulder having a tendency to swing its lower edge outwardly toward the inner surface of said tubular part, the tubular part having an upwardly facing inner surface portion inclined upwardly and outwardly, the lower edge of the flange of the cover part being disposed to engage against said inclined surface portion of the tubular part, and the tendency of the flange of the cover part to swing outwardly operating upon said inclined surface portion with a wedge-like action to constantly force the cover part into close contact with the under surface of said shoulder.

2. A receptacle closure comprising a tubular part having an inturned annular shoulder at one end, and a separately formed cover part disposed within the tubular part engaging the under surface of said shoulder to close that end of the tubular part, said cover part having a marginal flange formed thereon extending diagonally outwardly and downwardly away from said shoulder, having a tendency to swing its lower edge outwardly and upwardly toward the inner surface of the tubular part, the tubular part having an upwardly facing inner surface portion inclined upwardly and outwardly, the lower edge of the flange of the cover part being disposed to engage said inclined surface portion of the tubular part at only a slightly greater angle than the path of swing of the lower edge of the flange of the cover part, whereby the tendency of said flange to swing outwardly will operate upon said inclined surface portion with a wedge-like action to forcefully urge the cover part into close contact with the under surface of the shoulder.

3. A receptacle closure comprising a tubular part, and a cover part, the tubular part being formed intermediate its ends with a plurality of stiffening ribs extending longitudinally thereof formed by corrugations of the material of the tubular part, the tubular part being formed at the lower end of said stiffening ribs with means for detachably connecting the closure to a receptacle, and being formed at its upper end with an inwardly projecting shoulder spaced from

the upper ends of the stiffening ribs, the cover part being located within the tubular part engaging the under surface of said shoulder, and having a downturned marginal flange extending away from said shoulder toward the upper ends of said stiffening ribs, said flange having a tendency to swing its lower edge outwardly toward the inner surface of the tubular part, the upper ends of said stiffening ribs being beveled to provide upwardly and outwardly inclining surfaces interiorly of the tubular part, the lower edge of the flange of the cover part being disposed to engage said inclined surfaces, and the tendency of the flange of the cover part to swing outwardly operating upon said inclined surfaces with a wedge-like action to constantly force the cover part into close contact with the under surface of said shoulder.

4. A receptacle closure comprising a tubular part, and a separately formed cover part, the tubular part having a shoulder formed therein, the cover part being inserted within the tubular part and being held against movement in one direction by engagement with said shoulder, said cover part being formed with a marginal flange projecting away from said shoulder, said tubular part having struck-in portions engaging the edge of said flange to lock the cover part therebetween and said shoulder, said struck-in portions extending inwardly beyond their engagement with the edge of the flange of the cover part to form a second shoulder within said tubular part spaced from said first shoulder, and a lining within said cover part being held therein by engagement with said second shoulder.

5. A receptacle closure comprising a tubular part having an inturned annular shoulder at one end, and a separately formed cover part disposed within the tubular part engaging the under surface of said shoulder to close that end of the tubular part, said cover part having a down-turned marginal flange extending away from said shoulder, said tubular part having a plurality of stiffening ribs extending longitudinally thereof, terminating short of said shoulder and providing surfaces at their ends engaging the lower edge of the flange of the cover part to retain said cover part against said shoulder.

6. A receptacle closure comprising a tubular part having an inturned annular shoulder at one end, and a separately formed cover part disposed within the tubular part engaging the under surface of said shoulder to close that end of the tubular part, said cover part having a down-turned marginal flange extending away from said shoulder, said tubular part having a plurality of stiffening ribs extending longitudinally

thereof, terminating short of said shoulder and providing surfaces at their ends engaging the lower edge of the flange of the cover part, said flange of the cover part having a tendency to swing its lower edge across said ends of the stiffening ribs, and the end surfaces of said stiffening ribs being disposed at an angle relatively to the path of swing of the lower edge of said flange, so that the tendency of said lower edge to traverse said surfaces will wedge the cover part into tight engagement with said shoulder.

7. A receptacle closure comprising a tubular part having an inturned annular shoulder at one end, and a separately formed cover part disposed within the tubular part engaging the under surface of said shoulder to close that end of the tubular part, said cover part having a down-turned marginal flange extending away from said shoulder, said tubular part having a portion thereof bent inwardly to form the inner surface of said tubular part into an upwardly and outwardly inclining shoulder spaced from said first shoulder, the flange of the cover part being resilient and engaging said inclined shoulder to force said cover part toward said first shoulder.

8. In a device of the class described, the combination with a tubular member having a plurality of stiffening ribs formed longitudinally thereof, and having threads at the lower end of said stiffening ribs for attaching said tubular member to a receptacle, the upper end of said tubular member being formed with an inturned shoulder, and a separately formed cover part disposed within said tubular member engaging said shoulder, of a flange formed upon said cover part extending therefrom and engaging the upper end portions of said stiffening ribs to retain the cover part in engagement with said shoulder.

9. A receptacle closure, comprising a tubular part having a shoulder at one end thereof, and a separately formed cover part engaging against the under surface of said shoulder, said cover part having a down-turned flange thereon, said tubular part having an upwardly facing surface portion spaced beneath said shoulder engaging the lower edge of the flange of the cover part, said flange of the cover part having a tendency to swing its lower edge across said upwardly facing surface portion, and said upwardly facing surface portion being disposed at an angle relatively to the path of swing of the lower edge of said flange, so that the tendency of said lower edge to traverse said upwardly facing surface portion will wedge the cover part into tight engagement with said shoulder.

10. As an article of manufacture, a cap for bottles or the like comprising a strip of

sheet metal bent into the form of a cylinder having its end portions engaged with each other positively to prevent relative endwise movement and frictionally to resist relative lateral movement, said strip being corrugated lengthwise so that the ends of the strip being together the corrugations form a continuous thread, said corrugations also locking the joined edges of the strip against relative lateral movement, and a cap piece interlocked with one of the ends of the cylinder formed by said strip.

11. As an article of manufacture, a cap for bottles or the like, comprising a strip of sheet metal bent into cylindrical form and having its end portions engaged with each other to provide an interfolded seam, said strip having a plurality of longitudinally extending corrugations which, when the ends of the strip are together, form a continuous thread on said cylindrical member, said corrugations extending across and indenting the layers of the material of the strip forming said seamed portion, and a cap piece attached to one end of said cylindrical member.

12. As an article of manufacture, a cap for bottles or the like comprising a strip of material bent into cylindrical form and having its end portions engaged with each other and joined with each other by bent interlocking formations provided on the ends of the strip, said strip having a plurality of longitudinally extending corrugations which extend across and indent the engaged portions of the ends of the strip, said corrugations when the ends of the strip are together forming a continuous thread on said cylinder, and a cap piece located at one end of said tubular member, said cap and said tubular member having interengaging parts which hold them in fixed relation.

13. As an article of manufacture, a cap for bottles or the like comprising a body portion formed of sheet metal, said body portion being bent into cylindrical form and having the meeting edges thereof joined by an interfolded seam which conceals and covers the joined edges of the sheet metal, said seam positively locking said joined edges against relative endwise movement, and frictionally resisting a relative lateral movement between said edges, said strip being corrugated adjacent one of its lateral edges so that the ends of the strip being together the corrugations form a continuous thread, said corrugations also locking the joined edges of the strip against relative lateral movement, a cap piece interengaged with one of the ends of the cylinder formed by said strip, and means for covering and concealing the exposed edge of said cap piece.

14. A sheet metal cap for bottles or jars,

comprising a body portion formed of a sheet of metal, said body portion being bent into cylindrical form and having the meeting edges thereof joined by a seam which conceals and covers the edges of the metal, a top for closing one end of said body portion, said top being formed of sheet metal, and said top and body portion having interengaging formations whereby the top is held securely in place in said body portion, said sheet of metal being corrugated so that when the ends are seamed together the corrugations form a continuous thread, and said sheet of metal forming the body portion of said cap having a plurality of corrugations extending between the threaded portion and the top portion.

15. As an article of manufacture, a cap for bottles jars and the like, comprising a strip of material bent into the form of a cylinder and having its ends interlocked with each other against relative movement longitudinally of the strip, said strip having such corrugations that when the ends of the strips are so interlocked the corrugations form a continuous thread, and said strip having a cap piece interlocked with one end of the cylinder, the construction being such that all the joined portions of said cap piece are in interlocked relation, and means for covering and concealing the edge of said top.

16. As an article of manufacture, a cap for bottles or the like, comprising a strip of material bent into the form of a cylinder, and having its ends joined together by bent formations on the ends of the strip, said strip being provided with two sets of corrugations, one set extending longitudinally of the strip and so formed that when the ends of the strip are fastened together the corrugations form a continuous thread, and the other set of corrugations extending from said last mentioned set and disposed at an angle thereto, and a cap piece connected with the end of the cylinder adjacent the opposite ends of said last named corrugations.

17. As an article of manufacture, a cap for bottles or the like comprising a body portion formed of sheet metal, said body portion being bent into cylindrical form and having the meeting edges thereof lapped upon each other and joined together by bent interlocking formations provided on the end portions of the strip, said strip being corrugated adjacent one of its lateral edges so that the ends of the strip being together the corrugations form a continuous thread, said corrugations also extending across and indenting the lapped portions of the ends of said strip, said strip also being provided with a plurality of corrugations which extend from said first mentioned corrugations toward the other lateral edge of

said strip, and a top member interengaged with said last mentioned edge of the strip whereby said parts are firmly locked together, and means located within the body portion for covering and concealing the exposed edge of said cap.

In testimony whereof, I affix my signature in the presence of two witnesses:

LESLIE R. N. CARVALHO.

Witnesses:

L. GERSFORD HANSKE,  
NATHALIE THOMPSON.

May 3, 1966

J. L. METZENDORF ETAL

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CRAZE-RESISTANT PLASTIC CLOSURES

Filed Dec. 21, 1964

FIG. 1

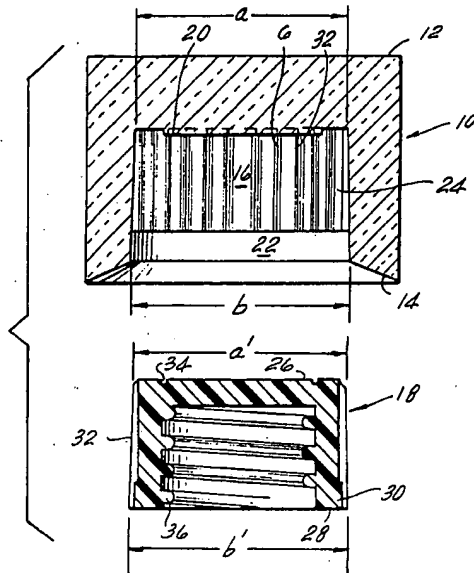


FIG. 2

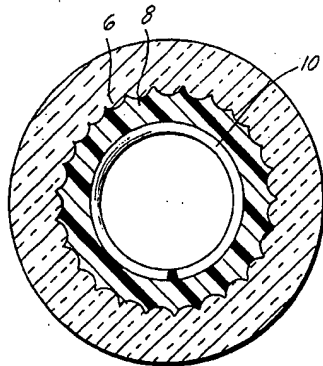
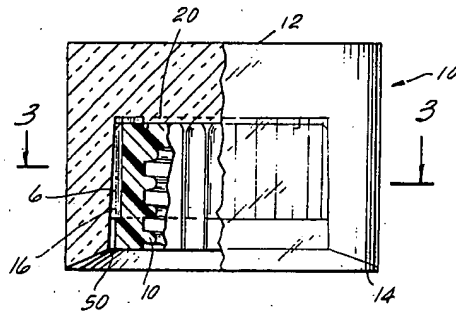


FIG. 3

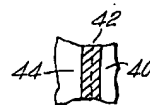


FIG. 4

INVENTORS  
JOSEPH L. METZENDORF  
ELI M. PEARCE  
BY JOHN M. JORDAN  
George P. Markes  
ATTORNEY

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## CRAZE-RESISTANT PLASTIC CLOSURES

Joseph L. Metzendorf, Easton, Eli M. Pearce, Allentown, and John M. Jordan, Bangor, Pa., assignors to J. T. Baker Chemical Company, Phillipsburg, N.J., a corporation of New Jersey

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This invention relates to plastic closures. More particularly, this invention relates to two-piece craze-proof or craze-resistant plastic closures which are particularly suited for bottles containing perfumes and other toiletries.

Frequently, caps of hard, lustrous and clear plastics cannot be used on containers for perfumes or other toiletries due to radial stresses or solvent crazing which mars their appearance. Although the organic liquid of the toiletry may not normally attack the plastic, contact of the liquid or its vapor produces crazing when normal closure stresses are present. Inserts can be used to inhibit solvent crazing by reducing contact between the contained liquid and the plastic and by absorbing the closure stresses required to seal the container. However, in the past, cap inserts have not been entirely satisfactory for this purpose since in many instances they have little effect in preventing crazing and often distract from the closure's appearance.

It is an object of this invention to provide an attractive and craze-resistant bottle closure of a clear and lustrous plastic together with a plastic insert.

It is another object of this invention to provide a closure as above described wherein the cap and insert have certain critical relative dimensions, each fluted to prevent relative rotation, and which are adhesively bonded together to provide the desired function and appearance while effectively preventing solvent crazing.

Broadly, the closures of this invention comprise a hard, plastic cap having a lustrous surface. The cap has a cavity therein for accommodating a plastic insert which is substantially unaffected by toiletries such as perfumes. The mating sides of the cap and insert are within certain tolerances or dimensions. The bottom mating edges of the cap and insert are bonded with an adhesive to prevent axial displacement and to obstruct organic liquids or vapors from penetrating between the cap and insert. The insert seals the mouth of the container and is keyed for common rotation with the cap, preferably by cooperating fluted mating sides of the cap and insert since the fluting gives an attractive and ornamental effect to the closure. In preferred embodiments, the caps are crystal-clear or translucent with a high surface luster, brilliance and clarity. However, the caps can be dyed transparent or semitransparent such as hazy blue caps or marbled black and red caps, which have a high surface luster. Generally the plastic material of the cap is glassy and amorphous. The inserts are preferably opaque.

This invention is illustrated by the attached drawings wherein:

FIG. 1 is a vertical cross section of the cap and insert closure components of this invention in unassembled relationship;

FIG. 2 shows the closure components of FIG. 1 in assembled relationship;

FIG. 3 is a cross section taken on the plane of the line 3-3 of FIG. 2; and

FIG. 4 is an enlarged cut-away bottom view of a segment of the adhesively secured mating surfaces of the closure at a spot 50.

Referring now to the drawings wherein identical numerals refer to identical parts, the numeral 10 represents a cap of a crystal-clear copolymer of alpha-methyl

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styrene and methyl methacrylate (e.g., BAVICK-11, manufactured by the J. T. Baker Chemical Company of Phillipsburg, New Jersey). In place of the particular polymer employed for the cap, other hard, lustrous and clear thermoplastic polymer materials having similar properties can be used such as: various acrylic polymers, e.g., methyl methacrylate; polystyrene; styrene-acrylonitrile copolymers; acrylonitrile-butadienestyrene copolymers; styrene-methylmethacrylate copolymers; polyvinyl-chloride; polycarbonates; and the like.

Cap 10 has a top 12, bottom 14, and a cavity 16 for accommodating insert 18. Cavity 16 is substantially cylindrical with a thin centrally disposed top shoulder 20, a smooth circular bottom ring 22 and inwardly protruding vertical fluting 24 about the sides thereof above ring 22.

Insert 18 is a plastic such as that of a urea-formaldehyde polymer and comprises a top 26, a bottom 28, an outer annular ring 30 at bottom 28, and fluting 32 which mate with fluting 24 of the cap. The annular ring 30 extends outwardly of the valleys of fluting 32 but just short of the ridges of fluting 32. Insert 18 also has a circular indentation design 34 at its top and internal screw threads 36 for securing about the mouth of a container. It will be seen from the drawing that the insert is imperforate and would completely seal the mouth of a container. The fluting of the cap and insert interlock and prevent relative rotation thereof.

The insert 18 can be of any polymeric material which is not affected by organic solvents and which has the strength to seal the liquid in the bottle effectively. The insert 18 can be prepared from a variety of thermoplastic or thermosetting polymers such as those of various phenolics, epoxy resins, polyurethanes, polyethylenes, urea-formaldehyde, Teflon, polypropylene, and the like in either filled or unfilled formulations. The insert can be colored or uncolored and is designed for the type of closure desired, e.g., snap-on, screw-on, etc.

In the assembled condition as shown in FIG. 4, the mating bottom edges of the cap and insert are secured with an adhesive. Also, the adhesive completely seals about the mating rings 22 and 30 of the cap and insert respectively, to obstruct penetration of liquids or vapors therebetween. It should be noted that a tight fit between the cap and insert without an adhesive seal increases rather than decreases the capillary action of liquid contact between the two interfaces.

Epoxy cements are preferred adhesives for use in this invention since they: (1) have low dimensional changes on curing; (2) generally do not contain harmful solvents; (3) provide strong bonds; and (4) can be formulated to give the desired appearance. Illustrative of suitable epoxy adhesives there can be mentioned those of Maraglas, No. 656 resin (89%) together with Maraglas No. 656 hardener (9%) and colloidal silica (2%). The resulting epoxy is cloudy white and provides good appearance when inserted along the annular rings between the lower edges of the cap and insert. The colloidal silica keeps the epoxy in place on the insert during assembly both before the cap is placed over the insert and during the curing period. However, the adhesive is not limited to epoxides or even relative clear materials. Additional suitable adhesives include various cements, polysulfides, etc. Preferably, the cured adhesive has an index of refraction substantially the same as that of the cap.

As stated hereinbefore, the relative dimensions of the mating sides of the cap and insert are critical with regard to the prevention of crazing and for enhancing appearance. In the case of acrylics, the outside dimensions of the insert must be such that the cap is forced to distort by less than 0.2% of its internal diameter. This reduces the stress to less than 1000 p.s.i. The maximum percent

distortion (of the internal diameters) for prevention of crazing for other polymers include: styrene-acrylonitrile polymers, 0.2%; general purpose polystyrene, 0.1%; impact polystyrene, 0.3%; acrylonitrile-butadiene-styrene polymers, 0.2%; polyvinyl chloride, 0.5%; and polycarbonate, 0.8%. Preferably, however, the outside diameter of the insert is equal to the inside diameter of the cap so that no compression of the cap takes place. The outside diameter of the insert can, of course, be smaller than the inside diameter of the cap, e.g., by 0.1% to 3%. However, it is preferred that the diameter of the insert be no smaller than the internal diameter of the cap.

The critical dimensions for the closures of this invention are broadly illustrated in FIG. 1 wherein *a* is the internal diameter of the cap at its top; *b* is the internal diameter of the hollow portion of the cap at its bottom; *a'* is the outside diameter of the insert at its top end, and *b* is the outside diameter of the insert at its bottom. Referring to the above values of maximum diameter elongations, it can be seen that for an acrylic cap the insert must have a diameter across its top of less than 0.2% greater than the internal diameter of the cap to prevent crazing of the cap. Thus, in this instant situation, assuming substantially the same diameter for the top and bottom of the mating parts of the closures a cap of 0.725" internal diameter, the outside diameter of the insert should be no greater than 0.7264". Also for a cap having 1.500" internal diameter, the outside diameter of the insert should be no greater than 1.530".

Table I which follows is a tabulation of crazing resistance versus cap and insert dimensions. It can be seen that whenever the caps were within the tolerances provided for hereinabove, crazing did not occur. However, when the differences were greater than provided for above, crazing was evident.

TABLE I

Crazing resistance versus cap and insert dimensions

	Case I	Case II	Case III
I.D. of cap:			
At top.....	0.725"	0.729"	0.739"
At bottom.....	0.742"	0.742"	0.744"
O.D. of insert:			
At top.....	0.741"	0.739"	0.739"
At bottom.....	0.746"	0.744"	0.744"
Required change in relative diameters on inserting:			
At top.....	0.016"	0.010"	0.000"
At bottom.....	0.004"	0.002"	0.000"
Percent elongation in top of cap assuming no deformation of insert.....	2.2%	1.4%	0.0%
Crazing after contact with perfume in short term laboratory tests.....	4 of 4 caps crazed within 1 minute.	4 of 4 caps crazed within 5 minutes.	None of 20 crazed after 4 week test.
Crazing in long term field test.....	With caps and inserts of Cases I and II and no sealing of insert into caps, 5 of 24 failed in 1 week, 14 of 24 failed in 6 weeks.		With Case III type, with sealing, 0 of 13 failed in 6 weeks.

What is claimed is:

1. A craze-resistant closure for a container comprising:
  - (a) a hollow cap insert having a top and sides of a polymeric material resistant to attack by organic liquids, said insert having means for engaging about the mouth of a container;
  - (b) a hollow cap of a hard thermoplastic polymer having a lustrous surface;
  - (c) the insert fitted within said hollow cap with the sides of said insert in close fitting relationship with the corresponding surfaces of said cap wherein the outer diameter of said insert is not more than 0.8% greater than the unstressed inner diameter of said cap;
  - (d) the outer configuration of said insert in assembled relationship keyed to the adjacent configuration of the cap to prevent rotation; and

(e) an adhesive securing the lower mating edges of said cap and insert and obstructing the penetration of liquids therebetween.

2. A closure of claim 1 wherein the cap is of a glassy substantially transparent polymer.

3. A closure of claim 1 wherein the adhesive is an epoxy adhesive.

4. A closure of claim 1 wherein the cap and insert have mating vertical fluting keeping the two together, wherein the insert has a diameter within the range of 0% to 0.8% greater than the unstressed internal diameter of said cap, wherein the cap is of a polymeric material selected from the group consisting of an acrylic polymer, polystyrene, styrene-acrylonitrile copolymers, acrylonitrile-butadiene-styrene polymers and alpha-methyl styrene-methylmethacrylate copolymers, polyvinyl-chloride and a polycarbonate and the insert is a polymeric material selected from the group consisting of a ureaformaldehyde resin, Teflon and polypropylene.

5. A closure of claim 1 wherein the cap is an alpha-methylstyrene-methylmethacrylate copolymer, the insert is a ureaformaldehyde polymer and the external diameter of the insert is not more than 0.2% greater than the unstressed internal diameter of the cap.

6. A craze-resistant closure for a container comprising:

- (a) a hollow cap insert having a top and sides of a polymeric material resistant to crazing by organic liquids and adapted to seal about the mouth of a container;
- (b) a lustrous cap of an acrylic polymer having a cavity therein fitting about said insert, the insert obstructing normal contact of liquids from the mouth of a container with said cap;
- (c) the sides of said insert and cap cavity having fluted mating surfaces to prevent relative rotation, the outer

diameter of the insert being within the range of about 0% to 0.2% greater than the unstressed internal diameter of said cap;

(d) the bottom mating edges of said insert and cap being adhesively secured to obstruct the passage of liquid therebetween.

7. A closure of claim 6 wherein the cap is substantially transparent.

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JOSEPH R. LECLAIR, Primary Examiner.

D. F. NORTON, Assistant Examiner.